

RAPTOR RESEARCH



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ANALYSIS OF NESTING MATERIALS FROM A GREAT BASIN FERRUGINOUS HAWK NEST

by

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Abstract

A newly constructed Ferruginous Hawk (*Buteo regalis*) nest was dismantled to determine the species origin, length, diameter and weight of each of the sticks of which it was constructed. Sagebrush (*Artemisia tridentata*) and juniper (*Juniperus osteosperma*) sticks composed 75.58% and 23.26% of the total. No significant deviation existed between sagebrush percent composition of the nest and that of vegetation surrounding the nest. The mean size of juniper sticks in the nest differed significantly from those on the ground in the vicinity of the nest. A possible explanation for the inclusion of rubbish in Ferruginous Hawk nests is offered.

Introduction

The Ferruginous Hawk (*Buteo regalis*) builds large bulky stick nests, and if available includes items such as paper, plastic sheeting, bones and manure (Weston 1969). In fact, nests have been described composed almost entirely of bleached buffalo bones (Williams and Matteson 1947). The nest cup is usually lined with strips of bark and grass.

A new nest may be constructed each year or an old one refurbished and used for several nesting seasons. The latter practice may result in nests of considerable dimensions. Behle, Woodbury and Cottan (1944) described nests measuring 2 m in height and 3 m in diameter, while Tavener (1919) estimated the height of a nest that had been used for a number of seasons to be 4-5 m. Weston (1969) found that the mean diameter of 24 newly constructed nests was approximately 1 m. He also noted that both members of the pair engaged in nest building and once started, worked continuously until the nest was completed.

We initiated this study in conjunction with one on nest site selection, in order to determine the types and sizes of sticks used in Ferruginous Hawk nest construction. We particularly wanted to know if the birds were selecting a specific type or size of stick or simply using what was conveniently available.

Study Site and Methods

A newly constructed Ferruginous Hawk nest was located in central Utah (N. latitude 40°00' and W. longitude 111°55') during June 1980. The area is typical cold desert habitat (Murphy et al. 1969). The nest did not

show any signs of use although a single male Ferruginous Hawk was present in the area during each of several nest visits.

As the nest was dismantled, the length, diameter, weight and species of each stick were recorded. In addition, the juniper bark lining the nest cup was weighed. The vegetational composition of the area around the nest was determined by counting the number of woody plants in 2 randomly chosen transects, 2 m by 50 m. They originated at the nest tree and extended outward to the north and east along ordinal lines. Two transects were considered sufficient because of the scarcity and uniformity of the existing vegetation. We also randomly selected dead juniper sticks, scattered within a radius of 25 m of the nest, and recorded the length and diameter of each.

Mean length, diameter and weight were calculated for the juniper and sagebrush sticks of the nest. The mean length and diameter of juniper nest sticks were compared to the means of those found around the nest, using F-tests ($P=0.05$). We compared sagebrush percent composition of the nest to that of the surrounding area with a chi-square test ($P=0.05$).

Results

The nest we dismantled was in the top of a juniper 3.2 m in height and as is typical, located at the edge of an open stand (Woffinden 1975). The nest measured 70×90 cm, while the nest cup was 30 cm in diameter and lined with 130 g of juniper bark.

Mean lengths, diameters and weights of the 258 sticks included in the nest are given in Table 1. Total weight of the nest was 11.13 kg. Sagebrush and juniper sticks were the major constituents; 75.58% and 23.26% respectively. Snakeweed (*Xanthocephalum sarothrae*), mustard (*Erysimum osperum*) and horsebrush (*Tetradymia canescens*) made up the remaining 1.16%.

Table 1. Type, Length, Diameter and Weight of Sticks Comprising a Ferruginous Hawk Nest.

Type of Stick	N	Mean Length mm	Range	SD	Mean Diameter mm	Range	SD	Mean Weight g	Range	SD
Juniper	60	481.57	180-1430	246.21	19.65	5-40	8.00	68.00	1-320	64.15
Sagebrush	195	302.41	110-930	111.59	24.45	8-54	7.92	35.35	6-140	28.89
Snakeweed	1	230.00	-	-	2.00	-	-	1.00	-	-
Horsebrush	1	300.00	-	-	18.00	-	-	6.00	-	-
Mustard	1	610.00	-	-	10.00	-	-	26.00	-	-

Sagebrush was the most commonly occurring woody plant in the area surrounding the nest tree, comprising 62.58% of the total. Snakeweed, horsebrush and juniper were less common with a frequency of 34.4%, 2.79% and 0.23% respectively. No mustard was found in the immediate vicinity, although it grew commonly along the roads in the valley. The nest tree was an isolated individual, but 33 other junipers of similar size were counted within a 125 m radius.

There was no significant deviation between sagebrush percent composition of the nest and that of the surrounding vegetation ($X^2=2.31$, $P=0.05$). Significant differences were noted when mean lengths and diameters of juniper nest sticks were compared to that of those in the surrounding area ($F=18.50$, length; $F=69.91$, width; $P=0.05$).

Discussion

The typical Great Basin Ferruginous Hawk nest is a large bulky structure constructed primarily of sagebrush and juniper sticks. Paper, animal dung, plastic, bones, grass and strips of bark are often included. Many raptor species add green leaves and twigs to their nest throughout the nesting season. The purpose of this behavior is not currently understood (Brown and Amadon 1968), although Newton (1979) suggests that it may serve to indicate an occupied nest or territory. Bent (1937) and Lokemoen and Duebbert (1974) described Ferruginous Hawk nests that contained greenery. We have not observed this behavior by them in our study area and find literature accounts of such to be quite rare. However, there are numerous descriptions of various types of rubbish being included in Ferruginous Hawk nests (Weston 1969, Bent 1937, Olendorff 1973, Smith and Murphy 1973, Thurow et al. 1980, Williams and Matteson 1947). Perhaps the incorporation of these atypical materials into the nest of this prairie species satisfies the innate urge of decorating the nest with greenery. The absence of green vegetation in Ferruginous Hawk nests in areas where it is readily available and routinely added to the nests of other sympatric raptors, supports this hypothesis.

Nest building is a time and energy demanding activity which undoubtedly would be compounded by active selection of a unique set of materials. The major constituents of Ferruginous Hawk nests differ throughout the range of the species, but it appears that in each area the bulk of the nest is composed of materials that are most readily available. The sagebrush percent composition of the nest we studied did not deviate statistically from that of the vegetation around the nest. Thus, we assumed that there was no species-specific selection of nesting materials, but choice was a function of availability. However, the juniper sticks in the nest were significantly smaller than those in the surrounding area, suggesting that size selection was occurring.

Imler (1937) lists the weight of adult male Ferruginous Hawks as 1,237 g (2 individuals) and of adult females as 1,983 g (3 individuals). The heaviest juniper stick from the nest weighed 320 g, which is approximately 26% of the male or 16% of the female weights listed above. We have found entire jackrabbit (*Lepus californicus*) carcasses in Ferruginous Hawk nests; the calculated weight of these was at least 825 g (Haskell and Reynolds 1947). It seems unlikely, then, that a stick of 320 g represents the maximum manageable size for this large raptor. Rather, it appears that the pair of hawks we studied were selecting nesting materials that were most readily available but within a given size class, even though this behavior could increase the energy cost of nest construction. In addition we suggest that Great Basin Ferruginous Hawks are substituting rubbish of various types for greenery in the decoration of their nests.

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A SURVEY OF RAPTORS IN NORTHERN UTAH, 1976-79

by

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Abstract

A roadside survey of raptors was conducted in Cache Valley, Utah during 3 (1976-77, 1977-78, and 1978-79) non-nesting seasons (November to mid-April). The Rough-legged Hawk (*Buteo lagopus*) was most numerous, followed in abundance by the Red-tailed Hawk (*Buteo jamaicensis*), Marsh Hawk (*Circus cyaneus*) and American Kestrel (*Falco sparverius*). Thirteen other species of raptors were observed. Male Kestrels were 2 to 3 times more abundant than females in December through March. Light phase individuals were 3 to 5 times more numerous than dark phase birds among Red-tailed Hawks and Rough-legged Hawks.

Introduction

The present study was undertaken to provide information on the relative numbers of raptors during the non-breeding season in Cache Valley, Utah. Surveys of raptors taken over several months from roads can provide information on distribution and seasonal changes in abundance of birds of prey.

Study Area

Cache Valley is bordered on the west by the Wellsville Mountains and Clarkston Mountains and on the south and east by the Bear River Range. The northern boundary of the study area was the Utah-Idaho border (Figure 1). Average elevation of the valley is 1,341 m. The area is a mosaic of agricultural lands (irrigated pasture and hayland, and dry cropland), urban areas, river floodplains, foothills, marshlands and open water.

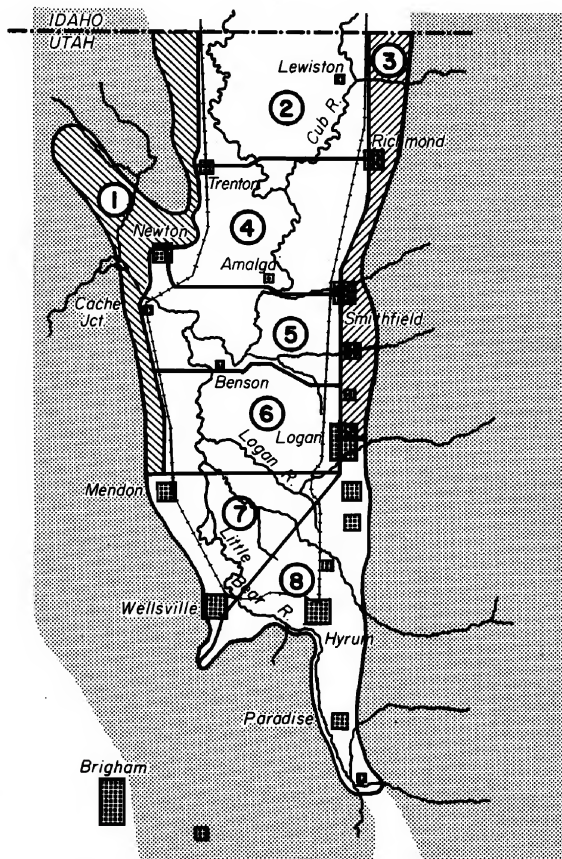


Figure 1.—A map of Cache Valley, Utah showing the 8 census areas included in the raptor survey.

Methods

About 95% of the total surface area in Cache Valley, Utah was divided into 8 census areas. These 8 areas ranged from 8,080 to 10,664 hectares. The total area censused was 77,024 ha (770.3 km²). The location of each area and its identification number are shown in Figure 1. The area of each habitat type is given in Table 1.

Table 1. The surface areas of seven major habitat types within eight census areas in Cache Valley, Utah

SURFACE AREA (HECTARES) OF MAJOR HABITAT TYPES IN EACH CENSUS AREA								
	1	2	3	4	5	6	7	8
Urban Area	157	236	2,788	189	583	677	661	3,182
Irrigated Pasture and Hayland	3,497	8,576	2,928	6,710	7,760	3,750	5,325	6,490
Dry Cropland	4,678	--	772	457	803	--	1,166	992
Native Grazingland	1,528	--	3,355	268	--	2,551	1,967	--
Open Water	63	--	--	63	457	472 ¹	--	--
River Floodplain	--	1,355	--	882	205	--	--	--
Marshland	--	64	--	315	267	630	205	--
Total Area	9,923	10,231	9,843	8,884	10,075	8,080	9,324	10,664

¹189 hectares is an open sewage treatment lagoon

Eight censuses of the total area were conducted between November and mid-April over a period of 3 winters; 1976-1977 (3 censuses), 1977-1978 (2 censuses), and 1978-1979 (3 censuses). The censuses, except for 20 January 1979, were completed over a period of 2 to 7 days. Usually each area was censused by a different group of observers. The number of observers in each group ranged from 2 to 6 (av. 2.4). The number of observers and total observer hours involved in each of the 8 censuses is reported in Table 2.

Each group tried to drive all of the paved and gravel roads in their census area. Sometimes snow made some gravel roads impassable. In addition, ungraveled roads that led to otherwise inaccessible areas were driven when road conditions permitted. The distance driven during each census is shown in Table 2.

Mean temperature, precipitation and snow on the ground for each census is given in Table 2. Wind during the censuses was less than 12 km/hr. Censuses were not taken during conditions of snow or rain that impaired visibility.

Table 2. A summary of kilometers driven, number of participants, and weather for each raptor census

Dates of Censuses Month Day(s) Year			Participants		Weather During Census Period			
			Total Km Driven	Number of Observers	Total Observer Hours	Temperature (°C) Mean Max	Mean Min	Snow On Ground (cm) Precipitation (cm)
Nov	3-7	1977	933	20	96.1	15.0	0.6	.38 on Nov. 6
Dec	2-8	1978	756	24	101.5	1.7	-7.2	.48 on Dec. 5
Dec	5-10	1976	825	11	--	5.0	-8.3	.20 on Dec. 5
Jan	20	1979	789	16	80.0	-2.2	-10.0	28 Trace
Feb	11-18	1978	805	17	75.0	2.2	-7.2	Everyday, total 1.9
Feb	19-23	1977	889	24	128.5	10.6	-3.3	.63 on Feb. 22
March	3-4	1979	686	20	83.5	1.1	-13.3	.66 on March 3
April	9-15	1977	784	18	90.0	17.8	1.1	.69 on April 15
Mean			810		93.5			

Results and Discussion

Relative Abundance

Rough-legged Hawks, Red-tailed Hawks, March Hawks and American Kestrels were abundant. Counts of 25 or more/day/1,000 km driven were usual for each species, and on average, they comprised 81% of the raptors in Cache Valley (Table 3). None of the raptors was categorized as common although the Prairie Falcon (*Falco mexicanus*) was fairly common. An average of 8.1 was observed in the Valley/1,000 km driven. A ranking of 10 uncommon raptor species (i.e., average counts of less than 4/census) from the most numerous to the least numerous is shown in Table 3.

A few Osprey (*Pandion haliaetus*) migrate through Cache Valley in April on their way to northern nesting grounds. The one observation of a Harris Hawk (*Parabuteo unicinctus*) was probably a semi-tame individual released by or escaped from a falconer. It was approachable at close range and was unmistakably identified.

Craig (1978) conducted a car survey over a 187 km route in southeastern Idaho during non-nesting seasons from November 1974 to May 1976 and found that Rough-legged Hawks were the most numerous, followed in abundance by the American Kestrel and the Golden Eagle (*Aquila chrysaetos*)¹

Seasonal Changes in Abundance

The Rough-legged Hawk and Prairie Falcon are winter residents (WR) in Cache Valley, but do not nest in the Valley nor in surrounding mountains. In the early March census, Rough-legged Hawks were still as numerous as in the mid-winter censuses and Prairie Falcons were still present (Table 4). In the mid-April census only 3 Rough-legged Hawks still lingered in the Valley but Prairie Falcons were absent.

American Kestrels increased dramatically from March to April as individuals migrated into the Valley to establish breeding territories. The Swainson's Hawk (*Buteo swainsoni*) appears in April as individuals arrived from their southern wintering grounds.

Distribution in the Valley

The 4 abundant species were observed in all 8 census areas, but were more abundant in areas 5, 6 and 7 in the central part of the Valley.

The Prairie Falcon was the only other species observed in all 8 areas. The average number of individuals observed per census ranged from 0.4 in area 3 to 1.9 in area 5.

The Sharp-shinned Hawk (*Accipiter striatus*) was absent in areas 2 and 8 where 87% and 94%, respectively, of the area is in urban development and irrigated pasture and hayland. The Short-eared Owl (*Asio flammeus*) was most numerous in census area 6. They were concentrated along a strip of old field that bordered the east side of the Logan sewage treatment lagoon. The Goshawk (*Accipiter gentilis*) was observed in the 4 areas that bordered the mountains (areas 1, 3, 7 and 8).

Sex and Color Phase Differences

From the census data of 3–7 November 1977, 20 January 1979 and 11–18 February 1978 where the color phase was identified for at least 75% of the birds observed, light

¹Ed. Note: Several people who have done similar roadside counts suggest one should use caution in using data from different years to show changes in seasonal abundance.

Table 3. Mean number of raptor species observed per census in 8 census areas in Cache Valley, Utah

Species	MEAN NUMBERS OF BIRDS OBSERVED PER CENSUS ¹ IN EACH CENSUS AREA								Percent of Mean Grand Total ¹	Total per 1,000 km Driven	Status ²
	1	2	3	4	5	6	7	8	Total		
Rough-legged Hawk	3.6	0.9	3.7	5.3	11.7	13.9	8.9	2.4	50.3	62.1	WR
Red-tailed Hawk	1.0	2.4	3.3	5.3	9.6	4.2	13.4	5.7	44.9	55.4	R
Marsh Hawk	1.7	1.9	0.9	4.8	9.6	10.9	8.9	0.7	39.3	48.5	R
American Kestrel	2.9	5.7	3.6	3.0	9.0	4.6	5.1	4.1	38.0	46.9	R
Unidentified Buteos	0.4	0.9	1.4	2.7	2.7	2.1	6.3	1.1	17.7	21.9	-
Prairie Falcon	1.1	0.6	0.4	1.1	1.9	0.6	1.0	0.9	7.6	9.4	WR
Short-eared Owl	0.0	0.1	0.0	0.0	0.0	4.4	0.1	0.0	4.7	5.8	R
Golden Eagle	0.0	0.3	0.4	0.1	0.3	0.3	0.4	1.0	2.9	3.6	R
<i>Aquila chrysaetos</i>											
Great-horned Owl	0.0	0.4	0.1	0.0	0.0	0.3	1.0	0.0	1.9	2.3	R
<i>Bubo virginianus</i>											
Bald Eagle	0.0	0.1	0.0	0.1	0.0	0.7	0.1	0.3	1.4	1.7	WR
<i>Haliaeetus leucocephalus</i>											
Sharp-shinned Hawk	0.1	0.0	0.1	0.1	0.1	0.3	0.1	0.0	1.0	1.2	R
<i>Accipiter striatus</i>											
Goshawk	0.3	0.0	0.3	0.0	0.0	0.0	0.3	0.1	1.0	1.2	R
<i>Accipiter gentilis</i>											
Cooper's Hawk	0.0	0.3	0.3	0.1	0.0	0.0	0.1	0.0	0.8	1.0	R
<i>Accipiter cooperi</i>											
Merlin	0.0	0.0	0.0	0.3	0.0	0.0	0.1	0.3	0.7	0.9	WR
<i>Falco columbarius</i>											
Harlan's Hawk	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.0	0.7	0.9	A
<i>Buteo harlani</i>											
	11.1	13.7	14.5	23.1	45.1	42.6	46.5	16.7	212.9	263.6	

¹The April 9-15, 1977 census was not included in these means.²WR = winter resident, R = year-round resident, A = accidental³Mean Grand Total = 212.9

Table 4. Number of individuals of each species observed in each census (columns A) per 1,000 km driven (columns B)

SPECIES	CENSUS DATES															
	Nov.		Dec.		Jan.		Feb.		Feb.		March		April			
	3-7	1977	2-8	1978	5-10	1976	20	1979	11-18	1978	19-23	1977	3-4	1979	9-15	1977
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Rough-legged Hawk	33	35.4	58	76.7	42	50.9	59	74.8	65	80.7	39	43.9	56	81.6	3	3.8
Red-tailed Hawk	57	61.1	57	75.4	38	46.1	47	59.6	35	43.5	46	51.7	34	49.6	29	37.0
Marsh Hawk	31	33.2	49	64.8	38	46.1	17	21.5	47	58.4	55	61.9	38	55.4	33	42.1
American Kestrel	36	38.6	30	39.7	40	48.5	41	52.0	53	65.8	27	30.4	41	59.8	174	221.9
Unidentified Buteos	21	22.5	21	27.8	17	20.6	22	27.9	14	17.4	18	20.2	11	16.0	4	5.1
Prairie Falcon	1	1.1	5	6.6	12	14.5	6	7.6	9	11.1	14	15.7	6	8.7	0	0.0
Short-eared Owl	0	0.0	2	2.6	0	0.0	15	19.0	1	1.2	0	0.0	15	21.9	6	7.7
Golden Eagle	4	4.3	5	6.6	2	2.4	3	3.8	1	1.2	2	2.2	3	4.4	4	5.1
Great-horned Owl	2	2.1	2	2.6	1	1.2	4	5.1	2	2.5	2	2.2	0	0.0	4	5.1
Bald Eagle	0	0.0	1	1.3	0	0.0	2	2.5	4	5.0	3	3.4	0	0.0	0	0.0
Sharp-shinned Hawk	2	2.1	0	0.0	0	0.0	1	1.3	1	1.2	0	0.0	3	4.4	1	1.3
Goshawk	0	0.0	0	0.0	1	1.2	2	2.5	0	0.0	3	3.4	1	1.5	0	0.0
Cooper's Hawk	0	0.0	0	0.0	2	2.4	1	1.3	0	0.0	2	2.2	1	1.5	2	2.6
Merlin	1	1.1	1	1.3	1	1.2	0	0.0	0	0.0	2	2.2	0	0.0	0	0.0
Harlan's Hawk	1	1.1	1	1.3	0	0.0	1	1.3	1	1.2	1	1.1	0	0.0	0	0.0
Swainson's Hawk															12	15.3
Osprey															1	1.3
Harris Hawk															1	1.3
Total	190	204	232	307	194	235	221	280	235	292	215	242	209	305	274	350

phase was more common than dark phase among both Red-tailed and Rough-legged Hawks. For Red-tailed Hawks 22 were dark phase, 116 were light phase and the color phase of 19 was not identified. Among Rough-legged Hawks 23 were dark phase, 76 were light phase and the color phase of 30 was not identified.

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WINTER ROADSIDE RAPTOR SURVEY IN EL PASO COUNTY, COLORADO, 1962–1979

by

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Abstract

A fixed-route car survey was conducted from October to February 1979–80 on a 103-km strip of predominantly rangeland east of Colorado Springs, Colorado. Comparison of these data with past relative density data from 1962–1979 shows fairly steady numbers for 7 of the 8 species. Rough-legged Hawks showed a slight decline. Most raptors were seen perched on REA poles. Cropland was used most by all species considering its availability to the area.

Introduction

Car surveys are a convenient method for sampling raptor populations which are conspicuous yet thinly distributed over large areas. Previous car surveys on rangeland in eastern Colorado have been conducted showing estimates of raptor abundance (Enderson 1965, Johnson and Enderson 1972, unpublished data) and behavioral data of perch-site preference (Marion and Ryder 1974, Stahlecker 1978).

The purpose of this study was to compare relative abundance and behavioral patterns with past data to investigate possible trends. Perch-site preference could be important in management of raptors on rangeland.

Materials and Methods

The 166 km² area about 12 km east of Colorado Springs, Colorado is a 103-km circuitous strip 1.6 km wide. It is predominantly (90.9%) rangeland comprised mainly of blue gramma (*Bouteloua gracilis*) and sandhill

bluestem (*Andropogon hallii*). The remainder is 4.0% cropland (primarily winter wheat, *Triticum anetivum*), 3.5% residential (where most trees occur), and 1.6% cottonwood (*Populus sargentii*) and willow (*Salix exigua*) riverbottom. The lack of tall vegetation makes the prairie ideal for spotting large birds at great distances.

Fenceposts are predominant perches available to raptors, running along both sides of almost the entire road and spaced about 5 m apart. Next are Rural Electrification Administration (REA) poles usually occurring along one side of the route about 0.1 km apart. Other potential perches include windmills, trees, large transmission line towers, and irrigation sprinkler towers (about 3.5 m high).

Censuses began 4 October 1979 and ended 1 February 1980. Thirty-one counts, totalling 3,194 km, were made between 3 and 6 h at a rate averaging 48 km/h. Fourteen surveys were made in October, 4 in November, 7 in December, 5 in January and 1 in February. All days of censusing were clear to partly cloudy and with winds no greater than 15 knots.

Species, location, activity and sex (when possible) of raptors seen were recorded. I tried to avoid recording the same bird twice by noting the direction it flew. Because I was both driving and observing, my sightings were necessarily biased to the vicinity of the road. However, the roads traveled were virtually traffic free and because I made a conscious effort to scan the sky, the results are not strongly biased to perching birds.

Results and Discussion

In all, 358 raptors of 8 species were seen. Most birds were perched (87%) (Table 1),

Table 1. Perching of raptors on 103-km route, Colorado, 1979-80

Species	flying or soaring	REA poles	fence posts	ground	wire	Number of observations (percent)		total seen
						power poles	other	
Red-tailed Hawk (<i>Buteo jamaicensis</i>)	2	21 (60)	1	4 (11)	-	-	7 (20)	35
Rough-legged Hawk (<i>Buteo lagopus</i>)	11 (16)	35 (50)	8 (11)	4	-	-	12 (17)	70
Ferruginous Hawk (<i>Buteo regalis</i>)	7 (15)	25 (53)	6 (13)	3	-	1	5 (11)	47
Golden Eagle (<i>Aquila chrysaetos</i>)	11 (22)	19 (39)	3	2	-	3	11 (22)	49
Marsh Hawk (<i>Circus cyaneus</i>)	17 (49)	4 (11)	3	11 (31)	-	-	-	35
Prairie Falcon (<i>Falco mexicanus</i>)	8 (13)	44 (70)	5	1	1	2	1	62
American Kestrel (<i>Falco sparverius</i>)	5	11 (19)	7 (12)	-	30 (52)	-	5	58
Merlin	2		1					3

contrary to the findings of Marion and Ryder (1974), but in agreement with those of Craig (1978). Roadside REA poles were the most common perch for all species except the Golden Eagle (*Aquila chrysaetos*), Marsh Hawk (*Circus cyaneus*) and American Kestrel (*Falco sparverius*). Stahlecker (1978) found a significant usage of 230kV transmission line towers in areas where they occur. I saw only 8 raptors, mostly Golden Eagles, on these towers even though I gave particular attention to them.

A seasonal change in abundance was noticed for 7 species in the study area (Table 2). The Red-tailed Hawk (*Buteo jamaicensis*) was seen in October but completely left the area by December. Of 35 recorded, 32 were identified as mature, 3 immature. The Ferruginous Hawk (*Buteo regalis*) was common in October and then decreased to a fairly

Table 2. Raptors seen per month on the 103-km route

Species	October		November		December		January	
	no. seen	birds 100 km	no. seen	birds 100 km	no. seen	birds 100 km	no. seen	birds 100 km
Red-tailed Hawk	29	2.2	2	.32	-	-	-	-
Rough-legged Hawk	14	1.0	8	1.3	16	2.6	31	5.0
Ferruginous Hawk	26	1.9	4	.65	4	.65	6	.97
Golden Eagle	15	1.1	6	.97	8	1.3	14	2.3
Marsh Hawk	17	1.3	4	.65	5	.81	6	.97
Prairie Falcon	34	2.5	14	2.3	6	.97	8	1.3
Kestrel	41	3.1	8	1.3	5	.81	4	.65
Merlin	-	-	-	-	1	.16	2	.32
km per month	1,340		618		618		618	

*Total number of raptors seen is less than in Table 1 due to the omittance of data taken on days of variable weather.

constant number throughout the remaining months. These 2 species of hawks apparently migrate through the plains in October. The Rough-legged Hawk (*Buteo lagopus*) was the most common winter raptor; their population increased as winter progressed. Golden Eagle population was steady until January when there was a noticeable increase. Of 49 sightings, 21 were identified as mature, 17 immature. Marsh Hawks dropped in number after October. Of the 35 individuals seen, 23 were identified as males and 10 as females. The Prairie Falcon (*Falco mexicanus*) was common the first 2 months, but decreased in numbers in December and January. Of 62 seen, 25 were identified as adults, 8 immature, 14 males and 20 females. American Kestrels, most abundant in October in migration, showed a decrease in numbers throughout the winter. Of 58 seen, 38 were identified as males and 10 as females. Only 3 sightings of the Merlin (*Falco columbarius*) occurred.

Relative to its availability, cropland was the favored habitat (Table 3). Wakely (1978) found a preference by Ferruginous Hawks for areas dependent upon the amount of vegetational cover rather than on prey densities. Similarly, I found Ferruginous Hawks only in open areas of low vegetation density (pasture and cropland). Open areas appeared to be favored by Rough-legged Hawks, Golden Eagles and Prairie Falcons. Red-tailed Hawks, Marsh Hawks and Kestrels were found in a variety of areas.

Table 3. Percentage of times raptors seen in habitats to the total times seen

Species	Habitats (percent of the area to the total roadside area)			
	Pasture (90.9)	Cottonwood/ willow (1.6)	Residences/ trees (3.5)	Cropland (4.0)
Red-tailed Hawk	71.4	8.6	5.7	14.3
Rough-legged Hawk	84.8	1.3	1.3	12.6
Ferruginous Hawk	78.8	-	-	21.2
Golden Eagle	83.7	-	-	16.3
Marsh Hawk	65.7	5.7	5.7	22.9
Prairie Falcon	76.2	-	-	23.8
Kestrel	77.6	1.7	3.5	17.2

Raptors seen/100 km traveled in earlier studies in the same area have been compiled by two-year periods to obtain a significant number of kilometers in each time period (Table 4). The data are subject to biases because of variations in methods used. The majority of censuses were made by one observer, routes were fairly similar to mine and were made in winter on clear days.

Table 4. Raptors (individuals/km) recorded in car censuses in El Paso County, Colorado, 1962-80

Species	62-64	69-70 71-72	72-74	74-76	76-78	78-80
Red-tailed Hawk	.15	1.8	6.8(h)	1.5	3.8	1.6
Rough-legged Hawk	6.9	6.1	2.6	3.9	5.5	2.5(l)
Ferruginous Hawk	.55	1.3	.26(l)	2.1	2.8(h)	1.4
Golden Eagle	1.2	2.7(h)	.52	2.5	.69	1.4
Marsh Hawk	2.8	1.6	.52(l)	1.8	4.5(h)	1.4
Prairie Falcon	2.3	2.1	1.3(l)	2.8	5.2(h)	1.9
Kestrel	1.2(l)	3.0	3.6	3.5	4.1(h)	2.5
Merlin	.33	.38	-	.38	.35	.08(l)
Total kilometers	674	782	386	1,065	290	3,540

Values are marked high (h) or low (l) if they vary significantly by t-test analysis for a 90% confidence interval using data from all years per species. Past data from published works of Enderson (1965), Johnson and Enderson (1972) and unpublished works of Enderson, R. Beidleman, J. Craig, P. Kennedy and B. Winternitz.

Merlins have the lowest density figures. Density was steady from 1962 until the last two-year period of 1978-80 when they reached a low. Prairie Falcons and Kestrels show fairly low variation in numbers throughout the years if the data for 1972-74 and 1976-78 periods are discounted because of the low numbers of kilometers traveled in these periods. In fact, these periods show most of the significant deviation. In view of this variation the populations of hawks and eagles appear steady throughout the years. The Rough-legged Hawk is an exception and showed a decrease (disregarding the two low mileage periods).

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HELPING AT THE NEST BY YEARLING MISSISSIPPI KITES

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Abstract

Helping at the nest by a yearling Mississippi Kite (*Ictinia mississippiensis*) was confirmed at 3 nests and strongly indicated at 15 others from nests studied during 1969–79. Helpers incubated, brooded and, most frequently, defended nests. For this species we believe that nest defense is a significant form of helping because predation on nests is a major source of mortality. Circumstantial evidence suggests that helping increases nest success and possibly benefits helpers, but more study is needed.

Introduction

Cooperative breeding is uncommon in raptors (Skutch 1961, Rowley 1976, Wiley 1975, Wegner 1976). It appears regular, in the form of polyandry, in only two species of falconiformes, the Galapagos Hawk (*Buteo galapagoensis*, Vries 1973, Faaborg et al. 1980) and the Harris' Hawk (*Parabuteo unicinctus*, Mader 1975, 1979). Here we present the first evidence of helping at the nest by Mississippi Kites, a locally common, often colonial species undergoing a major population expansion in the United States (Parker and Ogden 1979).

Methods and Study Areas

Ports intermittently observed a nest from a nearby blind for 20 hr from 8 to 26 June, 1976 in Woodland Park, a suburban area in Oklahoma City, Oklahoma. Parker made incidental observations during repeated visits to about 900 Mississippi Kite nests at 55 breeding colonies in western Kansas, Oklahoma and north-central Texas during 1968–73 and 1976–79 (Parker 1974, unpubl. data). Most colonies were in shelterbelts (wind-breaks) or similar vegetation. All or most kites in most colonies were observed simultaneously during flocking, but conclusive identification of 2 or more kites at a nest was made only for 209 nests. Observations (i.e., of nesting behaviors, size and plumage color) and banding experience with kites enabled us to sex adult kites if they were seen repeatedly or together. Adult males are lighter and smaller than females (Sutton 1944, Eisenmann 1963, Brown and Amadon 1968), and although the characters overlap, the two in combination are usually conclusive. Yearlings differ from adults by their barred rectrices and the occasional juvenal contour feathers on the abdomen, breast and wing linings. The sex of yearlings is difficult to determine unless a careful size comparison can be made.

Results

Yearling kites were present at about half the colonies studied by Parker. Although not all yearlings bred, most adults did. Yearlings were present at 52 of the 209 nests where

all kites were identified. A yearling appeared pair bonded to an adult for at least 35 (17%) of the 209 nests. At 2 other nests, a yearling helped an adult pair by incubating, brooding, or defending the nest against potential predators. Observations at 15 other nests suggested a similar alloparental yearling helper.

The kites' behavior at 2 nests with confirmed helpers is of greatest interest. The nest observed by Ports was attended by an adult male, an adult female and a large yearling female. During the first observation period, the 2 adults were perched near the nest and allowed the yearling to approach the nest, arrange nesting material, and incubate one egg for at least 90 min. The yearling incubated 2 eggs for 74 min. during the next observation period 5 days later and then sat alone near the nest for 90 min. Fifteen days later (the fourth observation period), the yearling perched near the nest for a minimum of 3½ hr while the adult female incubated. On one occasion, the adult male replaced the yearling on the nest. The yearling did about 15% of the observed incubation (164 of 1100 min.), the adult female about 84%, and the male very little.

Two adult kites were present during 6 of Parker's 11 visits to another nest in a short, lone black locust (*Robinia pseudoacacia*) about 13 km north of Englewood, Clark Co., Kansas. On 29 June, 1979 during the third visit to the nest, a yearling was frightened from this nest containing one egg and one very small nestling. No adults were present, and the yearling left the nest area as adults sometimes do when disturbed. The yearling was next and last seen near the nest on 6 July when it perched with one adult while the other soared nearby.

At the 15 nests where a helper was suspected, yearlings were often seen with 2 adults. At these nests yearlings were not observed to incubate or brood, but this was probably the result of inadequate observations because yearlings often perched at or near nests, were as disturbed by our presence as were the paired adults, and showed more alarm than other adults nesting nearby in the same colony. Typically the yearlings soared with 2 adults low over us and the nest, occasionally made low passes, and sometimes uttered alarm calls. They did not behave this way when we visited other nearby nests.

In 1971 in a mesquite grove near Jones County, Texas, 2 adults fledged 2 young at a nest where helping could not be confirmed except in terms of nest defense. During our last visit, a yearling was seen at the nest with one full-grown nestling. In 1972, this same nest (probably the same 2 adults based on Parker's experience with reuse of nests by kites) produced 2 fledglings. On 1 August 1972, 2 yearlings and 2 adults were present and all showed equal alarm and defense behavior when the fledglings were approached. Twice later a fledgling was seen flying with one yearling. At no nests, including the preceding, did adult kites show any aggression toward yearlings.

Discussion

Observations by other workers suggest that yearling Mississippi Kites help at nests (Seibel 1971, pers. comm. for Kansas, R. Glinski and R. Ohmart pers. comm. for Arizona). Hardin et al. (1977) observed yearlings with each of 4 breeding pairs of adults in southern Illinois, and S. Evans (pers. comm.) made similar observations at each of 6 active nests in the same population in 1980. Our observations are the first to confirm the existence of helping in the forms of incubation, brooding of nestlings, and nest defense. Whether or not helping is frequent is uncertain, but nest defense was the most observed form of helping by yearlings. Nest defense is frequently important in other species with helpers (Wilson 1975, Lack 1968, Brown 1978). For instance, predation is a major problem for the Florida Scrub Jay (*Aphelocoma coerulescens*), one of the most thoroughly

studied cooperative nesters (Stallcup and Woolfenden 1978, Woolfenden and Fitzpatrick 1978). This also seems true of the Mississippi Kite. Its predators, especially other raptors and large climbing mammals, kill adults on nests as well as many eggs and nestlings (Parker 1974, unpublished data). It is reasonable, then, that increased vigilance and nest defense against nest predators might represent a significant benefit and probably increased nest success. We believe the repeated presence of a yearling kite near a nest of 2 adults can be interpreted as a form of helping when the yearling defends the nest against predators.

In only a few bird species is helping actually shown to increase nest success (Rowley 1965, Woolfenden 1975, Brown 1978). Indeed, this is so for the Harris' Hawk (Mader 1979, 785). Our data, although circumstantial, suggest the same for the Mississippi Kite. Thirteen (72%) of the 18 nests with attendant yearlings raised at least one nestling to fledging age. This is significantly greater ($P < .05$, t-test comparing arcsin transformations of percentages) than a 48% nest success for 396 nests in 1969-1971 (Parker 1974) at which no helpers were detected. A possible bias is that 3 of the 18 were lone nests, and lone kite nests are statistically more successful than nests in colonies (Parker 1974). However, it seems unlikely that this could account for the considerable difference in success rates.

Fry (1972), Woolfenden and Fitzpatrick (1978) and Brown (1978) stressed that helpers may benefit from helping by learning and improving behaviors they will use in the future. Woolfenden (1975) demonstrated the benefits of helping for male Scrub Jay helpers, and Brown (1978) noted that for colonial species there seem to be few selective advantages for helpers except the acquisition of experience in the breeding situation. A helper kite would probably accept a minimal risk for its minor effort compared to the risks experienced by breeding adults, but it might enhance its familiarity with specific nesting and foraging areas, the locations and behaviors of predators, and adaptive responses to predators. Curio et al. (1978) showed that inexperienced European Blackbirds (*Turdus merula*) quickly learned to recognize and mob avian predators after observing mobbing of the predators by experienced blackbirds. This strongly supports the hypothesis that kite helpers benefit from association with breeding adults by observation of the adults' adaptive behaviors.

It is not surprising that the Mississippi Kites in the Great Plains exhibit nest helping because they show many characteristics often associated with group-breeding species (Woolfenden and Fitzpatrick 1978, Brown 1978, Wilson 1975, Fry 1972). They live in stable, small and somewhat isolated units and often forage in groups on patchily-distributed insects. They show relatively little sexual dimorphism (Snyder and Wiley 1976) and have a low reproductive rate coupled with a long life expectancy (Parker 1974). Their sex ratio apparently favors males 1.4 to 1 based on a sample of 120 adult specimens collected from throughout the species' breeding range. The kites' nesting environment is hot combining predictable elements, such as abundant nesting habitat, and unpredictable elements, such as local predation rates, the occurrence of storms, and insect food. In general its life history suggests a K-strategy. Clearly, additional detailed study at individual nests is needed before helping by yearling Mississippi Kites can be understood.

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BREEDING BIOLOGY OF RAPTORS IN THE CENTRAL APPALACHIANS

by

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Abstract

We have summarized the breeding chronology, productivity and food habits of the principal diurnal raptors of the Central Appalachian region from 1978–1980. Nest success varied from 53% for Red-shouldered (*Buteo lineatus*) to 86% for Broad-winged (*Buteo platypterus*) hawks. The average number of young fledged per nest attempt was 1.4, 1.8, 1.7 and 2.0 for Red-tailed (*Buteo jamaicensis*), Red-shouldered, Broad-winged and Cooper's Hawks (*Accipiter cooperi*), respectively. The principal prey species for this raptor community is the eastern chipmunk.

Introduction

Recent declines of a few raptor species demonstrate their sensitivity to ecosystem perturbations and the need for substantial baseline data.

Little research on raptor populations has been conducted in the Appalachian region. Studies of the breeding biology of populations provide data important for monitoring the future status of these populations and for establishing population norms against which effects of environmental changes may be assessed. In this study, nesting Broad-winged (*Buteo platypterus*), Red-tailed (*B. jamaicensis*), Red-shouldered (*B. lineatus*) and Cooper's (*Accipiter cooperi*) hawks were studied to determine the status of the raptor community in the central Appalachian region and to describe their nesting biology, chronology and food habits.

Study Area and Methods

Ground surveys for nests were conducted on two principal areas: Green Ridge State Forest and Savage River State Forest (Figure 1). Green Ridge State Forest, in eastern Allegany County, encompasses 10,522 ha (26,000 acres) of woodland ranging in elevation from 340 to 485 meters. Tree species include oak (*Quercus* spp.), ash (*Fraxinus* spp.), maple (*Acer* spp.) and hickory (*Carya* spp.). In bottom sites, white pine (*Pinus strobus*), poplar (*Populus* spp.) and mountain ash (*Sorbus americana*) are present. Some forest areas formerly converted to orchard plots now support Virginia pine (*Pinus virginiana*), pitch pine (*P. rigida*), short leaf pine (*P. echinata*) and table pine (*P. pungens*).

Savage River State Forest, in central and eastern Garrett County, totals 21,355 ha (52,770 acres) and ranges from 454 meters on the Savage River to 912 meters. Predominant vegetation is wild cherry (*Prunus serotina*), red (*Acer rubrum*) and sugar maple (*A. saccharum*), black (*Betula lenta*) and yellow birch (*B. lutea*), beech (*Fagus grandifolia*), basswood (*Tilia americana*), white pine and hemlock (*Tsuga canadensis*). Oak, tulip poplar (*Liriodendron tulipifera*) and hickory are characteristic trees of lower elevations.

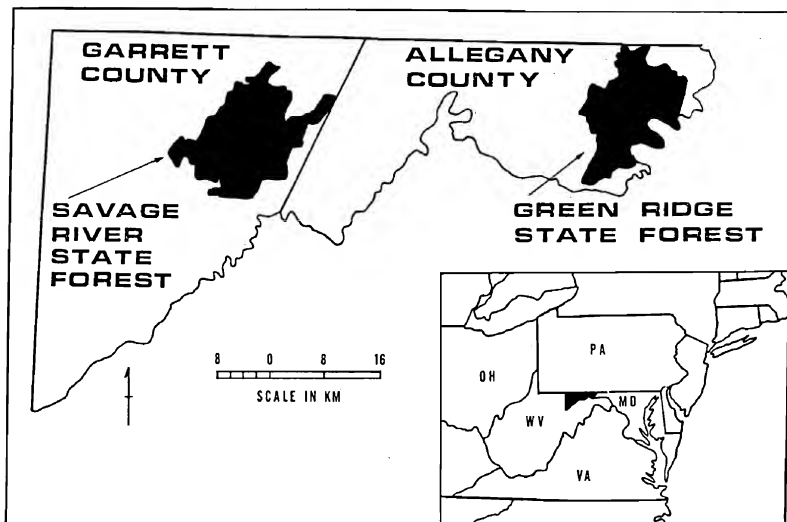


Figure 1. Location of Study Areas in Western Maryland.

Sections of both areas were systematically searched for stick nests during the 1978, 1979 and 1980 breeding seasons. Intensive searches were concentrated in February, March and April when breeding birds arrived and continued through leafing out of the trees. Vocalizations, aerial displays and sighting frequency were used to aid in locating nests. All nests were plotted on 7½ min U.S.G.S. maps. Nests were checked periodically for activity during each spring. Active nests were checked prior to egg hatching and during the first week thereafter to obtain clutch and brood sizes. Nest success was determined about the time of fledging.

Several nests were observed from ground blinds prior to hatching. During the first week after hatching, tree blinds were constructed 20 to 30 meters away at selected nests of each species for intensive observation with a 15-60X spotting scope.

Food habits were determined by observations of items brought to nests and from regurgitated castings found in or near nests. Castings were dissected following the methods of Mathiak (1938), Williams (1938) and Stickel (pers. comm.).

Results and Discussion

Breeding Population

Eighty-four active raptor nests were located in western Maryland during three breeding seasons. Nineteen were used by Red-tailed Hawks, 17 by Red-shouldered Hawks, 36

Table 1. Raptor breeding activity and productivity in the Central Appalachians 1978-1980.

	Red-tailed Hawk	Red-shouldered Hawk	Broad-winged Hawk	Cooper's Hawk
Number of active nests ¹	15	17	36	11
Number of successful nests	10 (67) ²	9 (53)	31 (86)	9 (82)
Clutch size	2 (1) ³	3.1(6)	2.7(15)	3.6(8)
Average number hatched	1.8(12) ³	2.4(8)	2.1(29)	2.9(9)
Average number fledged	1.4(14) ³	1.8(10)	1.7(34)	2.0(11)

¹Includes only those active nests for which the outcome was known, i.e., failed or fledged some number of young.

²Percent of active nests that fledged at least one young.

³Number of nests which contribute to the mean values.

by Broad-winged Hawks and 12 by Cooper's Hawks. Table 1 includes a summary of activity and productivity for those active nests for which the outcome was known.

Nesting Chronology

Nesting chronology is presented in Table 2. The dates presented are generally consistent with those previously published for each species (Burns 1911, Bent 1937, Stewart 1949, Hagar 1957, Rusch and Doerr 1972, Henny et al. 1973, Matray 1974, Portnoy and Dodge 1979). Cooper's Hawks were by far the most variable in the timing of their breeding cycle, with 28 days between the earliest and latest hatching dates for the three years.

Nest Success and Productivity

Raptor reproduction parameters are summarized in Table 1. Of 15 Red-tailed Hawk nests, 67% successfully fledged young. Nestling mortality was greatest during the second and third week after hatching, attributed to inclement weather and predation by Great Horned Owls. A total of 22 nestlings were produced averaging 1.8 young per active nest and 1.4 fledged. This compares to 66% nest success and 1.35 young per nest attempt derived from literature sources reporting a total of 930 nests (Fitch et al. 1946, Orians and Kulhman 1956, Hagar 1957, Roosa 1964, Harris 1971, Luttich et al. 1971, Seidensticker and Reynolds 1971, Gates 1972, Smith and Murphy 1973, Johnson 1973, Wiley 1975, Bohm 1978, Howell et al. 1978, Mader 1978, Adamcik et al. 1979 and Bednarz 1979).

Henny and Wight (1972) estimated that the northern Red-tailed Hawk populations must produce between 1.33 and 1.38 young per breeding attempt to maintain a stable population.

Of 17 Red-shouldered Hawk nests, 53% fledged young. Eggs from two nests were found crushed, and a third nest contained two addled eggs. Reasons for these failures cannot be determined. Human activity was determined to be a principal cause of Red-shoulder nest failure in California (Wiley 1975). Henny et al. (1973) found the most critical period for nestlings to be the first two weeks post hatching which is between late April and early May. A majority of the nestling mortalities in our study occurred during the first three weeks and in most cases involved the smallest nestling of the brood.

Mean clutch size was 3.1 with 1.8 young fledged per nest attempt. This compares to 1.7 young per nest attempt and 2.3 young per successful nest derived from literature sources (Craighead and Craighead 1956, Henny et al. 1973, Portnoy and Dodge 1979, Campbell 1975, Wiley 1975 and Bednarz 1979.)

Thirty-one of 36 Broad-winged hawk nests (86%) successfully produced young. Fifty-nine successfully fledged, averaging 1.7 per active nest (see Table 1). Nestling mortality for Broad-winged hawks was also greatest during the first three weeks.

Of the 11 Cooper's hawk nests, nine (82%) produced young. Twenty-six fledged, averaging 2.0 young per active nest. The number of Cooper's hawks to fledge per nest attempt in Maryland is about the same as that observed in Michigan (Craighead and Craighead 1956) and in Oregon (Reynolds and Wight 1978), but substantially higher than that observed by Hennessy (1978) in Utah.

Table 2. Raptor breeding chronology in the Central Appalachians 1978-1980¹.

	Egg Laying	Hatching	Fledging
Red-tailed Hawk	—0—	4/27 (11) 4/18-5/7	6/9 (3) 6/7-6/10
Red-shouldered Hawk	—0—	5/7 (7) 4/22-5/18	6/16 (5) 6/13-6/20
Broad-winged Hawk	5/1 (1)	6/10 (31) 5/27-6/20	7/13 (13) 7/6-7/24
Cooper's Hawk	5/4 (1)	6/19 (7) 6/7-7/5	7/18 (5) 7/2-7/19

¹Values given are the mean dates (sample size) over the range. Only nests for which these dates are known to be accurate within 1-2 days are included in the table.

Food Habits

We studied food habits in 1978 and 1979. For all species, mammals comprised the largest portion of the hawks' diet (Table 3). The eastern chipmunk (*Tamias striatus*) occurred most frequently in the diet of Cooper's, Red-shouldered and Broad-winged Hawks. Juvenile fox squirrel (*Sciurus niger*) comprised a major portion of the Red-tailed Hawk diet as determined through pellet analyses.

We observed 57 items delivered to nests by adult Cooper's Hawks 70% mammals and 30% small birds. This is quite different from the diet determined for Cooper's Hawks in New York and Pennsylvania (Meng 1959) in which avian species comprised a major portion of the diet. However, small numbers of avian species were also reported by Fitch et al. (1946) in California but in that study, lizards made up a majority of the food items.

Twenty-nine food deliveries were observed at Red-shouldered Hawk nests 79% mammals, 14% amphibians (frogs and salamanders) and 6.9% reptiles. This is similar to the food habits of Red-shoulders found in Massachusetts (Portnoy and Dodge 1979).

A total of 31 items were brought to nests by adult Broad-winged Hawks, 52% mammal, 10% birds and 6% reptiles. These proportions are similar to those found by Rusch and Doerr (1972) in Alberta and by Mosher and Matray (1974) in New York.

Small mammal activity patterns were being monitored on the same principal study areas during the two breeding seasons. Results from this study (Ladino 1980) show an early summer peak in activity of small mammals, particularly the eastern chipmunk and

Table 3. Food habits of raptors in the Central Appalachians 1978-1979¹.

PREY ITEM	Cooper's Hawk		Broad-winged Hawk		Red-shouldered Hawk		Red-tailed Hawk	
	Observ.	Pellet	Observ.	Pellet	Observ.	Pellet	Observ.	Pellet
Mammal								
<i>Tamias striatus</i>	28	3	6	18	11	4		3
<i>Microtus</i> sp.		2	3	6	2	2		1
<i>Peromyscus</i> sp.		1	1	4				
<i>Blarina brevicauda</i>	1		2	7	1	3		
<i>Sylvilagus floridanus</i>	2				1			
<i>Clethrionomys gapperi</i>					1	3		1
<i>Parascalops breweri</i>					1			
<i>Tamias hudsonicus</i>				1	3			1
<i>Sciurus niger</i>								6
<i>Sciurus carolinensis</i>								3
<i>Soricidae</i> sp.								1
Unidentified	9			4	4			1
Total (%) ²	40 (70)	6 (46)	16 (52)	35 (61)	23 (79)	10 (67)		15 (94)
PREY ITEM	Cooper's Hawk		Broad-winged Hawk		Red-shouldered Hawk		Red-tailed Hawk	
	Observ.	Pellet	Observ.	Pellet	Observ.	Pellet	Observ.	Pellet
Avian								
<i>Bonasa umbellus</i>			1	2			1	
<i>Melospiza gallopavo</i>	1		2					
<i>Colaptes auratus</i>			2					
<i>Pipilo erythrophthalmus</i>			1					
<i>Dryocopus pileatus</i>					1			
Unidentified	16	7	1	10		1		
Total	17 (30)	7 (54)	3 (10)	15 (26)	1	2 (13)		1 (6)
Reptile								
<i>Thamnophis sirtolii</i>					2	3		
Unidentified			2	5				
Total			2 (6)	5 (9)	2 (7)	3 (20)		
PREY ITEM	Cooper's Hawk		Broad-winged Hawk		Red-shouldered Hawk		Red-tailed Hawk	
	Observ.	Pellet	Observ.	Pellet	Observ.	Pellet	Observ.	Pellet
Amphibian								
Unidentified frog	-0-	-0-	-0-	-0-	3	-0-	-0-	-0-
Unidentified salamander	-0-	-0-	-0-	-0-	1	-0-	-0-	-0-
Total	-0-	-0-	-0-	-0-	4 (14)	-0-	-0-	-0-
Miscellaneous								
<i>Coleoptera</i>			-0-	1	-0-	-0-	-0-	-0-
Snail			-0-	1	-0-	-0-	-0-	-0-
Unidentified			10	-0-	-0-	-0-	-0-	-0-
Total	-0-	-0-	10 (32)	2 (4)	-0-	-0-	-0-	-0-

¹As determined by nest observation and analysis of casting.²Percent of total diet by observation or pellet analysis.

white-footed mouse (*Peromyscus leucopus*) in June and July for 1978 and 1979. The frequency of hawk predation on these species may be related to their abundance and availability at this particular time of year.

Acknowledgments

We wish to thank the following individuals for their assistance in various aspects of this field research: D. Lyons, F. Presley, M. Presley and K. Titus. This research was supported in part by contracts with the U.S. Fish and Wildlife Service (FWS 14-16-0009-77-960 and 14-16-0009-80-007). This is Contribution Number AEL-1220 of the Appalachian Environmental Laboratory, University of Maryland and Technical Report-4 of the Central Appalachian Raptor Ecology Program.

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UNUSUAL BEHAVIOUR OF THE SPOT-WINGED FALCONET (*SPIZIAPTERYX CIRCUMCINCTUS*)

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The following observations were made in Chulume, Rio Tercero, Province of Cordoba, Argentina (32°20' S, 64°50' W). The region is one of low hills, with native trees, dominated by *Acacia caven*, *Celtis tala*, *Geoffroea decorticans*, *Lithraea molleoides*. Average vegetation height is 4 m. The area is typical of half-open southern chaco forest.

Spizapteryx circumcinctus is a little known species in a monotypic genus found in the chaco region of central-northern Argentina and extends slightly into the chaco of Paraguay (Olrog 1959). The first known nest and eggs were presumably found as recently as 1947. The falconets were using an old stick nest of an oven-bird (Furnariidae) (Dean 1971). Its relationship to other members of Falconidae is not clearly understood and while Brown and Amadon (1968) consider it to be related to the Pigmy Falcon (*Polihierax* sp.) of Africa and south-western Asia, recent anatomical studies show that it is not related to *Polihierax* but rather the "aberrant Neotropical falcons," especially the caracaras (Olson 1976) (See Figure 1).



Figure 1.—Spot-winged Falconet in northern Argentina. Note this species' similarity to the Pygmy Falcon, with regards to its posture, short wings and long tail.

On 20 August 1980 we were recording Monk Parakeet (*Myiopsitta monachus*) calls in front of a solitary nest near a colony of about 20 nests located close to a more densely wooded area. We chose this nest in order to record single voices of *M. monachus* and then to evaluate their relationship with parakeet behaviour. At 18:10 hrs, while the sun was setting behind the hills, a pair of *Spizapteryx* arrived and began making vocal displays which we recorded for half an hour using play-backs. The male came toward us, repeated its vocal display and flew toward the nesting colony of *M. monachus*. When we approached the colony, doing play-backs of his voice, he started emitting alarm calls. Despite the fact that it was getting dark, we could see him clearly emerging from a parakeet nest continuously emitting alarm calls. Simultaneously we could also hear the alarm calls of the parakeets. After perching for a few minutes about 10 m. from us the falconet flew towards another parakeet nest and entered it. To our great surprise, 4 parakeets left this nest, flew around it emitting alarm calls only to re-enter it a few minutes later. In the same nest were now the falconet and 4 parakeets together.

We repeated the play-back of the falconet's voice and the same procedure occurred again, namely, the male falconet left the nest, emitting a few high pitched alarm calls, perched only 6 m. from us, and then entered a third parakeet nest, out of which flew 6 parakeets, circled excitedly around the nest and entered it later with the falconet still inside.

We did not use the play-back again and all birds remained where they were. It was obvious that the falconet was to spend the night in a nest together with the 6 parakeets. It is worthwhile to note that due to the play-back work to which we submitted this individual we were able to make him leave and enter three different nests, all of them inhabited by parakeets. This episode lasted about 45 min. We left the area at about 18:55. The female falconet was nowhere to be seen, and presumably left the area while we concentrated on our work with the male.

We feel that this behavior of *S. circumcinctus* deserves more studies and detailed data, but we also believe that our observation of this particular individual should not be considered rare. On another occasion, while Straneck was recording voices of *M. monachus* in exactly the same place, he saw another falconet flying towards the colony. As long as the falconet was flying, the parakeets in the colony were excited, emitting alarm calls. However, as soon as the falconet perched on a tree in the middle of the colony, the parakeets quieted down and normal activity resumed. Only when he took wing, and showed the typical raptor silhouette did the colony become excited again.

The behavior of this falconet around bulky stick nests with hole-type entrances is of particular interest in light of the fact that the African Pinyon Falcon (*P. semitorquatus*) nests and roosts in the nests of weaver finches (Ploceidae) (Maclean 1970). Weaver finch nests that are particularly used by the falcons are those of the Sociable Weaver (*Philetarius socius*) and have the general configuration of a large Monk Parakeet colonial nest. While these two falcons may not be particularly related they may prove to have shown a similar evolution of behavioral traits perhaps in response to the environment.

For this work we used a Uher 4000 report IC recorder and Dan Gibson P 200 parabolic microphone with BASF DP 26 tapes. All recordings are in the possession of Straneck.

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Olrog Claes Chr. 1959. Las Aves Argentinas. Una guía de Campo Inst. M. Lillo. Tucuman, Argentina.

A POSSIBLE HUNTING RELATIONSHIP BETWEEN TWO RAPTOR SPECIES

by

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The high plains of eastern New Mexico provide a wintering area for numerous raptors, including the abundant Northern Harrier (*Circus cyaneus*) and the less abundant but conspicuous Prairie Falcon (*Falco mexicanus*). While studying the Lesser Prairie Chicken (*Tympanuchus pallidicinctus*) in Roosevelt and Lea Counties, New Mexico, a possible relationship between these 2 raptor species was noted.

On 6 occasions throughout January and February 1980, I saw Prairie Falcons apparently hunting close to actively hunting Harriers. On these occasions, I saw a Harrier hunting over open grassland and cultivated grainfields in their typical low flying manner, while a Prairie Falcon flew approximately 30–50m above and 50–100m behind. As the Harrier coursed across the fields, the accompanying falcon stooped on rising birds which were flushed by the hawk. Although I saw neither species take prey, the association appeared deliberate. Bourne (1960) and Watson (1977:92) observed similar relationships between the Hen Harrier (*C. c. cyaneus*) and Merlin (*F. columbarius*).

These incidents may be an example of a behavioral symbiosis. Prairie Falcons often capture prey that flushes out in front of them (Enderson 1964). However, potential prey in good cover is often hesitant to flush due to the falcon's flying ability. Conversely, the Harrier's low flight pattern and long legs enable it to most effectively capture prey on, or very close to, the ground (Watson 1977:87). For avian prey, the apparent response to a Harrier overhead would thus be to flush ahead of the hawk. It is apparent then, that a Prairie Falcon could facilitate its own hunting by utilizing a hunting Harrier as a flusher. By hunting in association with a Harrier, a Prairie Falcon may actually increase its encounter rate with prey items. The benefit which the Harrier receives from this relationship is less apparent. Perhaps the hawk benefits by taking birds which are hesitant to flush in the presence of the falcon.

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FOOD OF THE SPOTTED OWL IN UTAH

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In this paper we report a sample of prey of the Mexican Spotted Owl (*Strix occidentalis lucida*) from southern Utah. Food habits of this species are poorly known compared to many other North American owls (Earhart and Johnson 1970). Diet of the Mexican race is least well known. A few casual records are available from Arizona and New Mexico (Huey 1932, Ligon 1926) but only seven prey individuals were previously reported for Utah (Kertell 1977). Forsman (1976) and Barrows (1980) have reported the only comprehensive analysis of Spotted Owl foods from Oregon (*S. o. occidentalis*) and California (*S. o. caurina*), respectively. Reports of other, mostly very small collections of prey, were reviewed by Barrows (1980) and Zarn (1974).

The Spotted Owl is listed as a rare permanent resident in Utah (Behle and Perry 1975) and is found in habitats very different than the dense, old growth forests occupied by other races. Kertell (1977) felt that cool retreats were necessary for roosting and nesting in the hot summers of southern Utah; these are found in narrow, steep-walled canyons.

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On 20 August 1980 we were recording Monk Parakeet (*Myiopsitta monachus*) calls in front of a solitary nest near a colony of about 20 nests located close to a more densely wooded area. We chose this nest in order to record single voices of *M. monachus* and then to evaluate their relationship with parakeet behaviour. At 18:10 hrs, while the sun was setting behind the hills, a pair of *Spizapteryx* arrived and began making vocal displays which we recorded for half an hour using play-backs. The male came toward us, repeated its vocal display and flew toward the nesting colony of *M. monachus*. When we approached the colony, doing play-backs of his voice, he started emitting alarm calls. Despite the fact that it was getting dark, we could see him clearly emerging from a parakeet nest continuously emitting alarm calls. Simultaneously we could also hear the alarm calls of the parakeets. After perching for a few minutes about 10 m. from us the falconet flew towards another parakeet nest and entered it. To our great surprise, 4 parakeets left this nest, flew around it emitting alarm calls only to re-enter it a few minutes later. In the same nest were now the falconet and 4 parakeets together.

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In view of the difference in habitat, comparative studies of the 3 races of Spotted Owl could prove valuable in terms of trophic divergence. Accordingly, we present here additional food data for the Mexican race. Even though this sample is limited in size and locality, some interesting comparisons are possible with diets of Spotted Owls from other areas.

Spotted Owl pellets were collected in 1977 from below roosts in Capitol Reef National Park, Utah, where Spotted Owls were observed. The collection site was a deep, narrow sandstone canyon. Water in this, and the main canyon it adjoins, was ephemeral. Vegetation in the canyon bottom was a mixture of grasses, forbs, cacti and sparsely scattered boxelder (*Acer negunda*), cottonwood (*Populus* spp.) and bigtooth maple (*A. grandidentatum*) trees. Vegetation on the plateau above the canyon was dominated by Utah juniper (*Juniperus osteosperma*), Colorado pinyon (*Pinus edulis*) and mixture of shrubs (*Shepherdia*, *Cercocarpus* and *Ephedra* spp.). Prey identified are presented in Table 1.

Table 1. Prey of the Spotted Owl from southern Utah.

Prey species	Number	Percent frequency
<i>Antrozous pallidus</i>	1	0.9
<i>Peromyscus</i> spp.	16	15.2
<i>Neotoma cinerea</i>	14	13.3
<i>Neotoma lepida</i>	53	50.5
<i>Neotoma</i> spp.	9	8.6
Orthoptera	1	0.9
Arachnida (scorpion)	1	0.9
unidentified invertebrates	10	9.5
Total	105	100.0

In California (Barrows 1980) and Oregon (Forsman 1976), nearly all prey was characteristic of forest habitats. Interestingly, even though the habitat in southern Utah is very different, consisting of desert canyons and plateaus, the major prey was woodrats (*Neotoma* spp.) as it was in California. Woodrats ranked second overall in diet biomass of Oregon Spotted Owls and were the most important prey in drier habitats there. Fewer mammalian species occurred in the Utah diet and no birds were found. These differences could be attributable to the smaller sample size from Utah. Obviously, much more study is needed to elucidate the feeding ecology of this species in the distinctly different areas of its distribution.

We thank Jerry Hoddenback for collecting some of the pellets.

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ABSTRACTS OF THESES AND DISSERTATIONS**PREY SIZE SELECTION BY WILD AMERICAN KESTRELS (*FALCO SPARVERIUS*) WINTERING IN SOUTHCENTRAL FLORIDA**

In order to test prey size preferences, free ranging American Kestrels (*Falco sparverius*) hunting from roadside perches were each offered a pair of white laboratory mice (*Mus musculus*), representing two of four size categories (7–14 g, 15–22 g, 23–30 g, 31–38 g). Female kestrels were observed significantly more often than males in the study area. The larger mouse of a pair was selected significantly more often than the smaller mouse. Electivity indices showed that mice of the smallest size category were selected below their availability and that the greatest proportional number of attacks was directed towards mice of the largest size category. Mouse activity, determined by the number of 10 cm grid crossings, was directly proportional to mouse size. Thus either differential size or activity may have functioned as a stimulus for prey size selection. These results support an energy maximizing model of predator choice and are in direct opposition to results obtained from laboratory studies of owl and shrike prey size selection. A new technique for testing preferences of roadside hunting raptors for variable prey characteristics is described.

Smallwood, John A. 1981. Prey size selection by wild American Kestrels (*Falco sparverius*) wintering in southcentral Florida. M.S. Thesis, Miami University, Oxford, Ohio.

BOOK REVIEWS

The Birds of Prey of Southern Africa. C. G. Finch-Davies and A. C. Kemp. 1980. Winchester Press, Ltd., Johannesburg, South Africa. 339 pp.

This is an exceptional book that unfortunately is limited to 1726 volumes. Therefore, if you don't have a copy by now you may not get one. The book certainly merits a review because of the significant contribution to the history of ornithological art and biology of African raptors it presents. Basically the book contains the art work of the late Lt. C. G. Finch-Davies (1875–1920) with commentary on each species by Alan Kemp, Curator of birds at the Transvaal Museum. Finch-Davies grew up in British colonialist tradition and like so many 19th century British ornithologists lived in both India and Africa. He had a varied and controversial career and if he takes a place in history it will be because of his art work and not his career and achievements as a military man. While the late and legendary Leslie Brown has often been said to be the authority on African raptors his only edge on Alan Kemp has been his age. Alan's intimate knowledge of raptors, his keen ability as an observer and his intuitive common sense about raptors biology have been manifest throughout his narrative species accounts.

The book contains 141 color plates, including the frontispiece; 124 plates of diurnal raptors and 17 of owls. Of the 59 species of diurnal raptors shown all but 15 depict adult and juvenile plumage and in all but a handful of cases there are more than one plate per species. The 12 species of owls shown are all adult but one. While most of the art work

is of a similar quality it spans a 10 year period from 1910 to 1919. Some plates show excellent fidelity, eg. the cream-backed form of the Bateleur (*Terathopius ecaudatus*) while others have some minor problems with body proportions such as the juvenile Black Sparrowhawk (*Accipiter melanoleucus*). Plates that I particularly like are the male Jackal Buzzard (*Buteo rufofuscus*), immature Tawny Eagle (*Aquila rapax*) and the adult female White-faced Owl (*Otus leucotis*). Several species, eg. Smaller Banded Snake-eagle (*Circaetus cinerascens*), and Long-legged Buzzard (*Buteo rufinus*) have occurred in southern Africa since Finch-Davies' time and although not illustrated they are nonetheless mentioned by Kemp.

While not a trained ornithologist Finch-Davies became an excellent observer and clarified the fact that the immature of the Red-headed Falcon (now named *Falco chiquera*) was just that and not a different species that had been named (*Falco horsbrughii*). He also clarified a similar adult-immature confusion with a hawk-eagle (*Hieraaetus*).

Dr. Kemp's background is thoroughly zoological and African; born in Zimbabwe of British ancestry. While he has a keen interest in raptors, his Ph.D. work was on hornbills (*Tocus* sp). Much of the earlier nomenclature of raptors is preserved by Kemp and differs from that preferred in the most recent Peters *Check-list of Birds of the World*. Many of the forms Kemp calls full species are referred to as "megasubspecies" in Peters; forms approaching full species status. For example, Kemp places the Tawny Eagle (*Aquila rapax*) as a species apart from the Steppe Eagle (*Aquila nipalensis*) and two distinctive African buteos (*Buteo rufofuscus* and *B. augur*) are treated as different species rather than both subspecies of the former as preferred in Peters. I do not know what bird is called the Mountain Buzzard (*Buteo tachardus*) by Kemp but I presume it to be the African Mountain Buzzard (*B. oreophilus*) of other check-lists. Dr. Kemp's intuitive knowledge of raptors is superb. He has included new data in the book from his own observations, for example, data on the Dickinson's Kestrel (*Falco dickinsoni*) behavior. When my family and I visited the Kemps in Pretoria in 1981, I watched the Dickinson's Kestrels in a large cage in his backyard and one need only watch them and their fast parrot-like movements for a short period to realize how different they are from other "kestrels". Through studies like Dr. Kemp is doing he should help clarify the more accurate affinities and relationships of many of the aberrant African raptors such as this kestrel.

I heartily recommend that one familiarize himself with this book and glean the new knowledge of the remarkable diverse and abundant African raptor fauna that is scattered throughout the text. This book will stand for some time to come as the most complete of its kind on birds of prey of Southern, if not all, Africa.

C. M. White

ANNOUNCEMENTS

THE WILLIAM C. ANDERSEN MEMORIAL AWARD

1. THE AWARD

An award for the best paper presented by a student at each Raptor Research Foundation Annual Meeting.

2. THE MAN

Although his profession was chemistry professor at Otero Junior College, La Junta, Colorado, Bill Andersen's first love was raptors. He established the Ornithology Re-

search Center at Otero Jr. College as a medium for fund-gathering for the raptor field investigations he and his students conducted. His interest in the raptors utilizing the grasslands of southeastern Colorado naturally evolved into developing a solution to the almost universal problem of public misunderstanding and persecution of birds of prey. Bill established a rehabilitation facility to treat injured raptors which were brought to him by the public and he tirelessly lectured to service clubs and school groups about the benefits of raptors. Success of his efforts was apparent from the reduction in shot raptors encountered there in the wild. He was a strong supporter of the Foundation, and a number of his students accompanied him to the Foundation's Annual Meetings. Bill's enthusiasm, sincerity, and humor sparked an interest in raptors among many of his students and associates.

While participating in the 1980 North American Peregrine Falcon Survey Bill and a partner were canoeing on the hazardous Churchill River in northern Manitoba. Owing to a severe drawdown in the water level, they unexpectedly encountered extremely turbulent water and capsized. Bill disappeared, and presumably drowned, while engaged in two of the activities he most enjoyed. Raptors and raptorophiles have lost a strong ally.

3. PROCEDURES

- a. When submitting an abstract of a paper and applying for a place in the paper sessions of a RRF Annual Meeting, a student wishing to be considered for this award must include the following note on the abstract: "to be considered for the Andersen Student Award."
- b. Eligibility:
 - (i) the student must be a registered full time or part time student at a recognized educational institution.
 - (ii) the information contained in the paper must have been collected/synthesized primarily by the student.
 - (iii) the paper must have been organized and written by the student with (at most) only relatively minor editorial assistance from faculty and colleagues.
 - (iv) if necessary the paper may carry the names of supervisor(s) and colleague(s) as joint authors.
- c. A committee of three RRF officers and/or directors (or their appointees) will independently evaluate all eligible papers as presented, and will meet to determine the award winner.
- d. The award will be presented before the close of each RRF Annual Meeting and will be announced in *Raptor Research* and other journals and ornithological newsletters.
- e. The award will consist of an inscribed plaque.

Criteria for evaluation should include, where applicable, these categories:

- | | |
|---|----|
| —the presentation | 30 |
| —ease of delivery | |
| —quality of AV aids | |
| —adherence to time limit | |
| —the organization of topics within the paper | 20 |
| —ease of following the logic and steps involved | |

- the information presented
- thoroughness of background explanations
- quality of the investigation
- quality of interpretation of findings

50

100

STUDENT INTERNSHIPS IN RAPTOR RESEARCH AT MCGILL UNIVERSITY, MONTREAL

For the summer of 1982, the Macdonald Raptor Research Centre of McGill University is offering four student internships to university students interested in raptor research, rehabilitation and public awareness. The Centre maintains a colony of 400 captive hawks, falcons and eagles and also conducts field studies in the surrounding area. Each student will gain experience in raptor care and management, public tours of the Centre, rehabilitation of sick and injured raptors, and each will be assigned to a specific research project. Free university residence is available within walking distance of the Centre. Please submit a resume of previous experience with a letter of recommendation to:

Dr. David M. Bird
Raptor Research Centre
McDonald Campus of McGill University
21,111 Lakeshore Road
Ste. Anne de Bellevue, Quebec H9C 1C0
1-514-457-2000, ext. 345

MRRC RAPTOR RESEARCH AVAILABLE

A compendium of all research projects either completed or in progress during the years 1974 to 1981 at McGill University's Raptor Research Centre has been published. Abstracts of 27 projects dealing with birds of prey are included. For a copy of the report, please send \$2.00 for handling charges to Dr. David Bird at the above address.

ABSTRACTS OF 1981 RRF CONFERENCE AVAILABLE

The 1981 Raptor Research Foundation conference in Montreal was a resounding success in spite of a modest turnout (300 participants) compared to previous years. Federal restrictions on travel prevented many U.S. federal officials from attending. Abstracts of approximately 50 papers presented at the RRF meeting are presently available. If you wish copies, please send your request along with \$2.00 per copy to:

Ms. Toni Bird
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